

MARINE TURBINES

thus the breaking or retardation effect is greater. In turbine steamers the direction of rotation of the shaft has been changed within 12 s. of the giving of the signal.

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Late in 1904 the Cunard Company resolved to adopt the turbine drive in their latest Atlantic liners. This decision, coupled with the important

recommendation of a special committee appointed by the Admiralty to adopt the system for all armoured ships, was the means of finally crystallizing opinion in favour of the system. The *Carmania*, of the Cunard Company, was built with turbine machinery in 1904, and, at the same time, a sister ship, the *Coronia*, was built, but fitted with reciprocating engines.

The turbine installation proved entirely satisfactory, and showed great improvement in comparison with the sister ship, and in the ensuing year many further applications were made, not only for high-speed steamers, but for vessels for other services.

Two of the largest ships built up to 1922 driven by turbines were the *Mauritania* and *Ludtania*.

In connection with these installations much research work was done, both as regards the turbines themselves and in connection with the propellers. Four shafts were adopted, each to transmit up to 20,000 h.p., and each with one propeller. Six turbines were installed, two high-pressure and two low-pressure ahead and two high-pressure astern. The two outer shafts were driven by the high-pressure ahead turbines and the two inner shafts by the low-pressure ahead turbines. The high-pressure astern turbines were placed forward of the two low-pressure on the centre shafts. The two condensers were each in a separate compartment abaft the low-pressure ahead turbines, and the auxiliaries were situated still farther aft. The rotor drums for the turbines for these ships were forged. This was a new departure, but it has now become general for large installations.

Geared Turbines. — In reviewing the progress made since the introduction of the turbine as a prime mover for steamships, it is remarkable

development has followed closely the lines which were mapped out in the early installations. The most radical and far-reaching innovation is the adoption of gearing.

In warship work variability of speed is required with economy at all speeds. On the other hand, the merchant steamer is always running at about its maximum speed, but that speed is not required to be a particularly high one in the average vessel.

Both the conditions in the war vessel and in the merchant ship are more easily met by the introduction of mechanical gearing, and, moreover, it is possible to run the turbine at a more economical speed, and at the same time get a greater efficiency from the propeller. In the merchant vessels one solution of the problems involved has been given by introducing combination machinery — that is, reciprocating engines for dealing with the high-pressure steam, and turbines which take the exhaust from these and expand the steam down to a low vacuum, since the turbine can make use of a very